

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
31 December 2003 (31.12.2003)

PCT

(10) International Publication Number
WO 2004/000435 A1

(51) International Patent Classification⁷: B01D 25/176, 33/067

(21) International Application Number:
PCT/GB2003/002706

(22) International Filing Date: 23 June 2003 (23.06.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0214574.6 25 June 2002 (25.06.2002) GB

(71) Applicant (*for all designated States except US*): MADI-
SON FILTER 981 LIMITED [GB/GB]; Knowsley Road
Industrial Estate, Haslingden, Lancashire BB4 4EJ (GB).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventor; and

(75) Inventor/Applicant (*for US only*): ROBERT, Bell
[AU/AU]; 63 Apex Avenue, Belmont, VIC 3216 (AU).

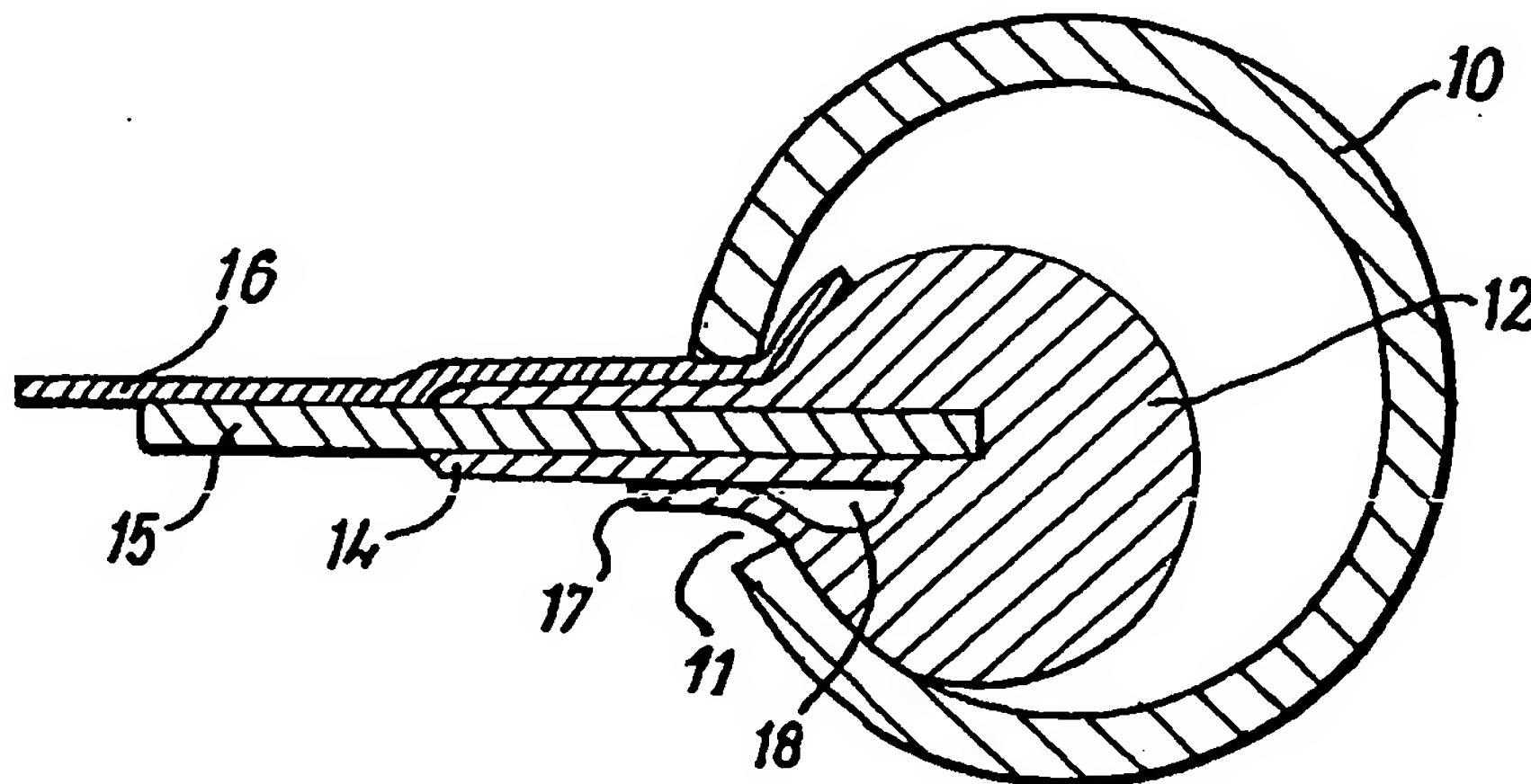
Published:

— with international search report

(74) Agents: MIDDLEMIST, Ian, Alastair et al.; Wilson
Gunn M'Caw, 41-51 Royal Exchange, Cross Street,
Manchester M2 7BD (GB).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: RETENTION OF FILTER ELEMENTS



(57) Abstract: An edge of a filter cloth (16) is joined to a bead member (12), which has flaps (13, 14) embracing a reinforcing fabric part (15) which is attached to the filter cloth. The bead member (12) also has a flap (17), with an included space (18), which provides a sealing surface with a "C" shaped edge retaining channel member (10). The bead (12) is wider than the slot (11) of channel member (10), but smaller than the internal diameter thereof. Two "C" shaped conical members may be carried back to back, or four embodied in a member (40), for assembly between filter panels. In a variant, the bead member is elliptical so that it can be inserted into a channel in one orientation, and held after rotation through 90°. This bead member may contain a rigid core.

WO 2004/000435 A1

Improved Retention of Filter Elements

This invention relates to improvements in the retention of filter elements, particularly to apparatus for retaining and tensioning the edges of filter cloths as used on drum, pan or disc filters.

5 EP-A-0,888,801 discloses a filter belt edge structure having an edge strip and a track portion or edge bead integrally formed therewith. The edge strip has a slot extending into the strip from the free edge parallel to the plane of the strip, dividing the free edge region of the strip into a pair of superposed flaps, between which the edge region of the
10 filter cloth is received and joined to the flaps by thermal or acoustic welding and/or stitching

In WO97/24170 tubular edge beads or retaining bodies are provided on the edge regions of the filter cloths and are received in slotted tubes, which are retained in the side frame members of a filter
15 panel. The edge beads are of resilient material and are shallow so that they can be easily deformed to enter the slotted tubes, but are usually inserted into the tubes from one open end. In WO 00/04975, a frame member for filter panels comprises an extruded body formed with a plurality of grooves with access slots, which are narrower than the
20 diameters of the grooves into which compressible edge beads formed on edge strips are inserted. The edge strips are generally similar with a different cross-section of bead to those described in EP-A-0,888,801 but in general they are similar, being cut to provide superposed flaps between which the edge of the filter cloth can be introduced, and secured by
25 adhesive, thermal or ultrasonic welding and/or stitching.

In practise, however it has been found that the seal between the bead and the slotted channel is not watertight so that particles of the

filtrate can enter the tube. The particles, which thus lodge themselves in the tube, are difficult to remove by washing, so that after several filtration cycles the removal and replacement of the bead, by pulling out from the slotted tube becomes very difficult. The tube may be damaged (for
5 example by forcing the edges of the slot so far open they cannot be sufficiently closed again) and need to be replaced.

When the bead is welded to the edge strip, an area of the strip is exposed between the filter cloth and the slotted tube. When subjected to high slurry pressures particles damage the cloth strip weld leading to pin
10 hole damage to the weld and ultimately to weld failure.

An object of the invention is to provide apparatus for retention of filter elements which will effectively prevent access of filtrate particles to the slotted tube, and whereby the filter cloth can be removed and replaced without substantial risk of damage to the slotted tubes.

15 In accordance with the invention, apparatus for retention of filter elements comprises a cavity mounted in or forming part of the frame member for supporting a filter element, and an extruded bead member attached to an edge of a filter cloth, wherein the bead member is profiled to provide a sealing surface which forms a seal with the edges of the slot
20 of the slotted cavity when the filter cloth is subjected to tension.

The sealing surface can be provided by a lip provided by the bead profile, and the cavity by a slotted tube.

The bead may be extruded onto a cloth strip, so that the bead material forms extensions substantially covering each face of the cloth
25 strip and the main body of the bead is formed on one edge of the strip. The lip may be provided by a flap separated from the extension covering

the face of the strip opposing the flap by a channel and extend in the same general direction as the extension from the main body of the bead.

The bead preferably has a diameter sufficient to cause it to be retained by the slot of the slotted tube, being significantly larger than the
5 width of the slot, but is also preferably less than the internal diameter of the slotted tube so that when placed under tension the bead can be drawn into the slot to exert sealing pressure on the flap.

The filter cloth may be attached by welding, adhesive or stitching to the side of the extension covering the cloth strip opposite to the
10 channel and lip so that the cloth is gripped by one jaw of the slot of the slotted tube.

A preferred embodiment of retention arrangement for a filter element in accordance with the invention will now be described by way of example with reference to the accompanying drawings wherein: -

15 Figure 1 is a sectional view of a retention arrangement for a filter element according to the invention, not subject to tension;

Figure 2 is a sectional view of the same retention arrangement as Figure 1, wherein the filter element is under tension;

Figure 3 is a sectional view illustrating the back-to-back mounting of
20 slotted tubes forming part of such retention arrangements, on a frame member separating two adjacent panel filters or like devices;

Figure 4 is a sectional view of a variant embodiment; and

Figure 5 is a sectional view of a frame member is a disc filter between
25 disc segments, e.g. as in WO 00/04975, with retentional arrangements according to the invention.

As shown in Figure 1 a retention arrangement according to the invention comprises a slotted tube 10, of steel or resilient plastics material, having a slot 11 extending along one side thereof. A bead 12 of resilient material is received within the slotted tube 10, the bead 12
5 having a diameter greater than the width of the slot 11 in its relaxed state, and significantly less than the internal diameter of the tube 10. The bead 12 is substantially of circular cross section but is formed with a pair of extensions 13, 14 which embrace a reinforcing strip of textile fabric 15 one extension being secured by means e.g. of welding,
10 stitching, adhesion or extrusion of the bead onto the edge of the strip 15 to each side of the strip 15 to substantially completely overlie strip 15 on both sides.

The edge of a filter fabric 16 is stitched welded or adhered to the outer side of one of the extensions 13, so that the filter fabric 16 is
15 securely attached to the bead 12.

The bead 12 further comprises separated from the other said extensions 14 and flexible flap 17 separated from the extensions 13, 14 and fabric strips 15 by a channel 18.

The function of this flap 17 is best shown in figure 2 wherein the
20 arrangement is shown as subject to tension acting from the left of the drawing on the filter fabric 16, wherein the tension pulls the bead into the slot 11, and forces the flap 17 into engagement with the outer face of the extension 14 to thereby provide a seal.

The benefits of this arrangement are that improved sealing is
25 provided preventing entry of liquor or filtrate into the tube 10 as the filter cloth is attached to both the beading and the cloth strip. Any material

will enter the channel 18, and be expelled by variation in the tension of the lip 17 causing material to be forced out of the channel 18.

In previous devices, such as WO 97/24170, slurry could enter the tube and was then difficult to remove and the particles would build up
5 inside the tube making insertion and removal of the beading difficult. The tubes often of metal and welded to the machine frame needed to be replaced. With the invention this problem is mitigated. Further, due to the Fig. 1 arrangement, only filter cloth 16 is exposed to the slurry during operation which prevents the slurry from coming into contact with the
10 cloth strip, the beading or the weld, thereby preventing pinhole damage even at high pressures.

Figure 3 shows a back to back arrangement of two slotted tubes 10a, 10b welded together at 20 and connected by a bar 21 to which both tubes 10a, 10b are also welded.

15 Each slotted tube 10a, 10b will receive a bead structure as shown in figures 1 and 2 so that a frame member is provided to support adjacent filter panels in a drum, disc or segmented filter apparatus.

Figure 4 shows a variant embodiment wherein the filter cloth 30 is received between flaps of a web 31, which is in turn connected to a
20 sealing element 32, of suitable resilient material, and elliptical cross-section. This provides a sealing surface 33 which engages with a shoulder 34 of a channel sectioned member 35 in which the element 32 is received. As shown by broken lines, the element 32 can easily be inserted into the channel member, then rotated through 90° to engage
25 with the shoulder 34, being "jammed" into the position shown in full lines, to resist tension acting on the element 32 via the web 31. The element 32 has a rigid core, e.g. of metal reinforcement, which can be in

the form of a flat bar, oriented in the direction of the major axis of the element 32 and longer than the width of the mouth of the channel member.

Figure 5 shows the use of retention elements in accordance with the invention, as applied to a frame member 40 dividing sector panels 51, 52 of a rotary disc filter. The frame member 40 itself comprises a plastics or rubber body having a central bore in which a reinforcing metal tubular member 50 is received. The frame member 40 is a moulding or extrusion provided with four narrow-mouthed channels 41, 42, 43, 44 in which are received edge bead arrangements 45, 46, 47, 48 attached to the edges of four filter cloths 16 one of which is provided on each face of the panels 51, 52 for retention in the channels 41 to 44. The arrangements 45 to 48 are each substantially as described with reference to Figures 1 and 2.

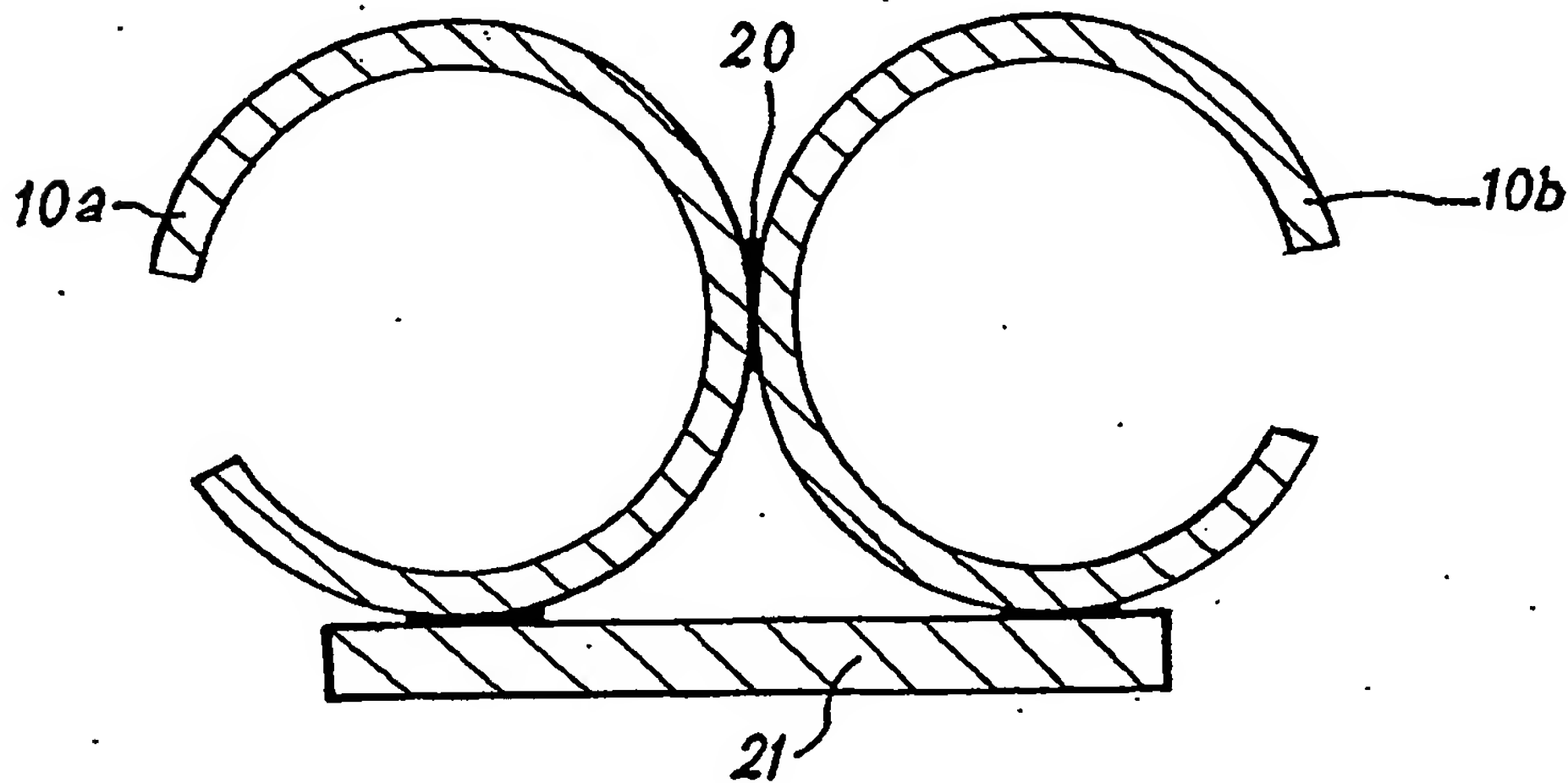
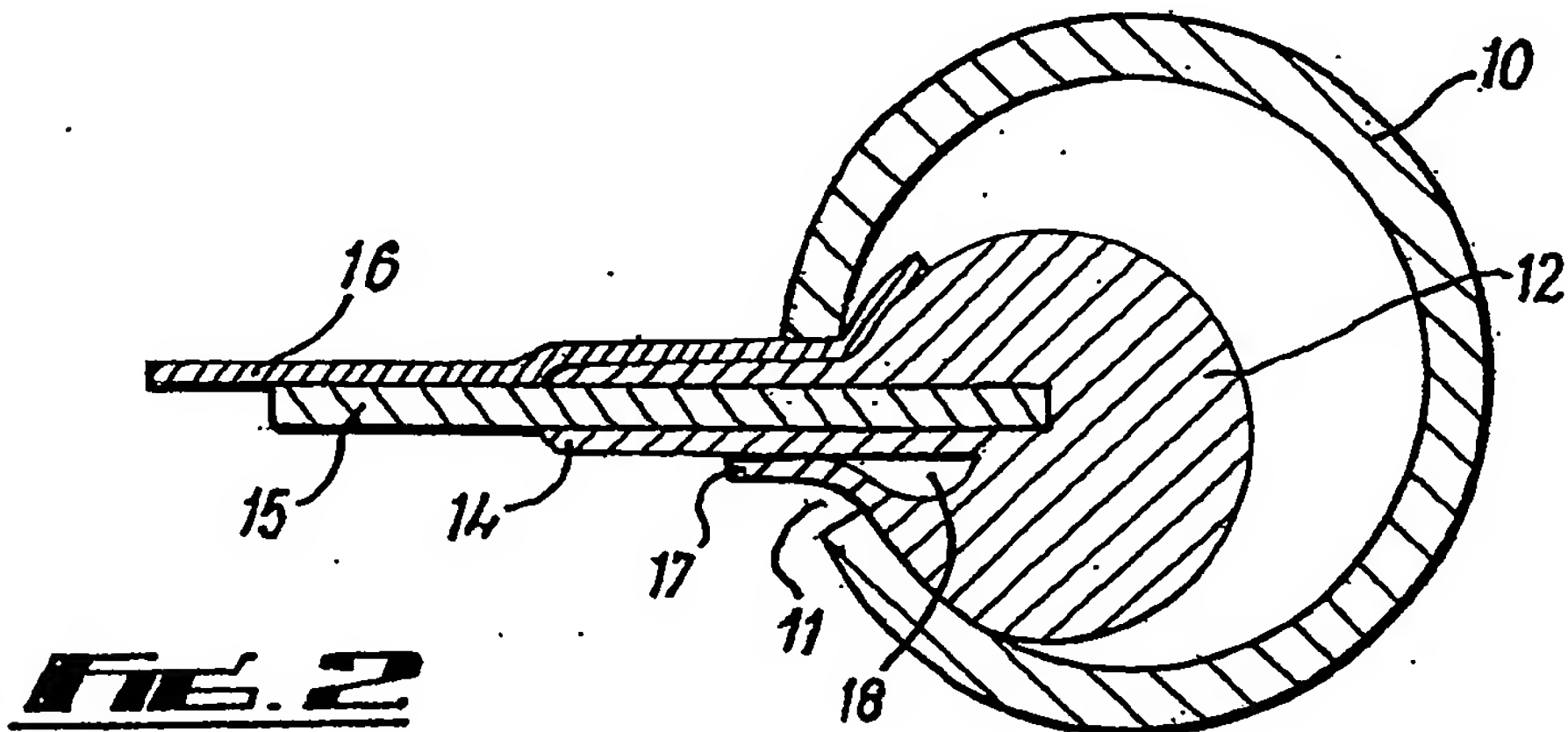
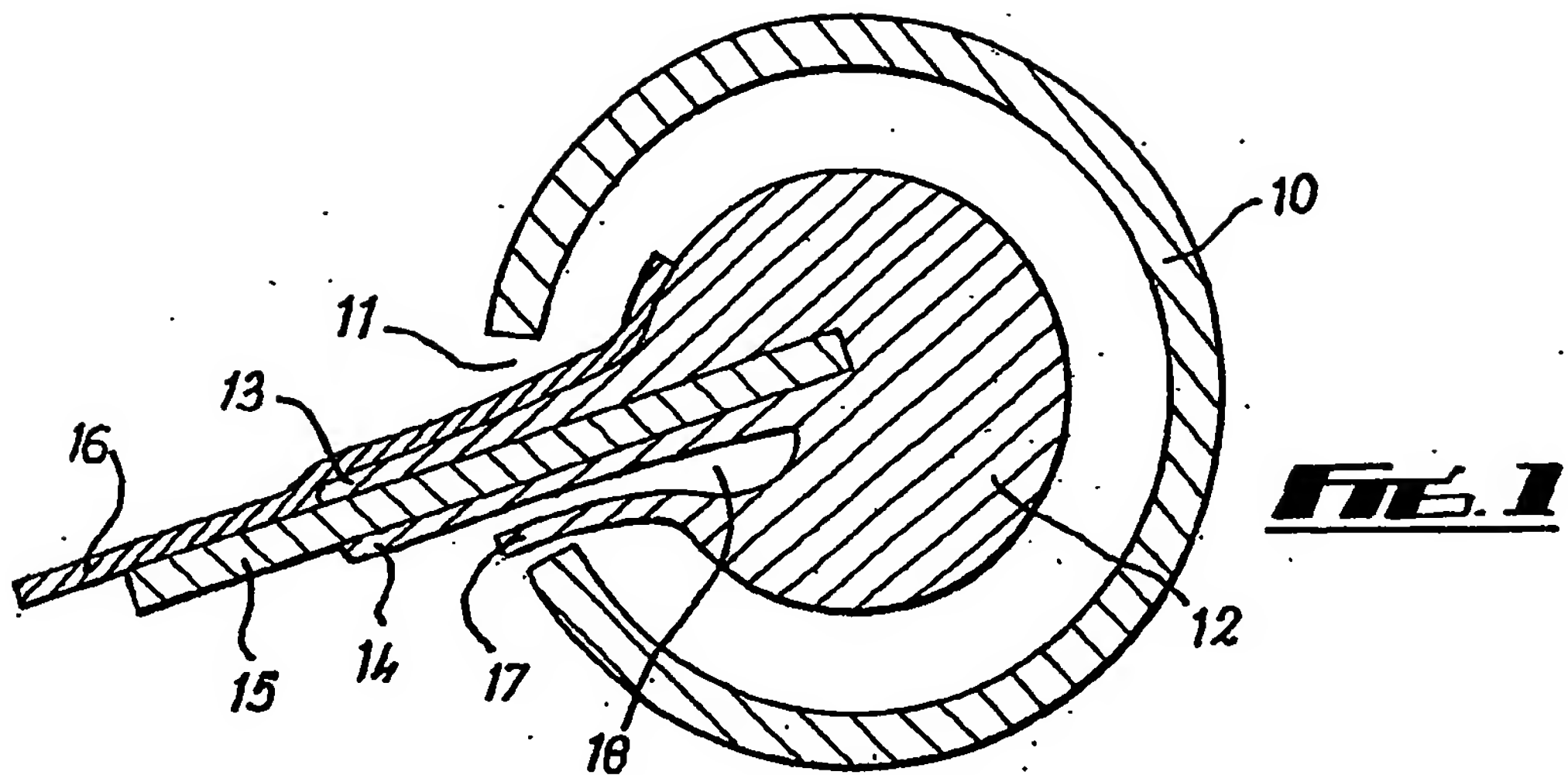
It is of course to be understood that the invention is not intended to be restricted to the details of the above embodiments which are described by way of example only.

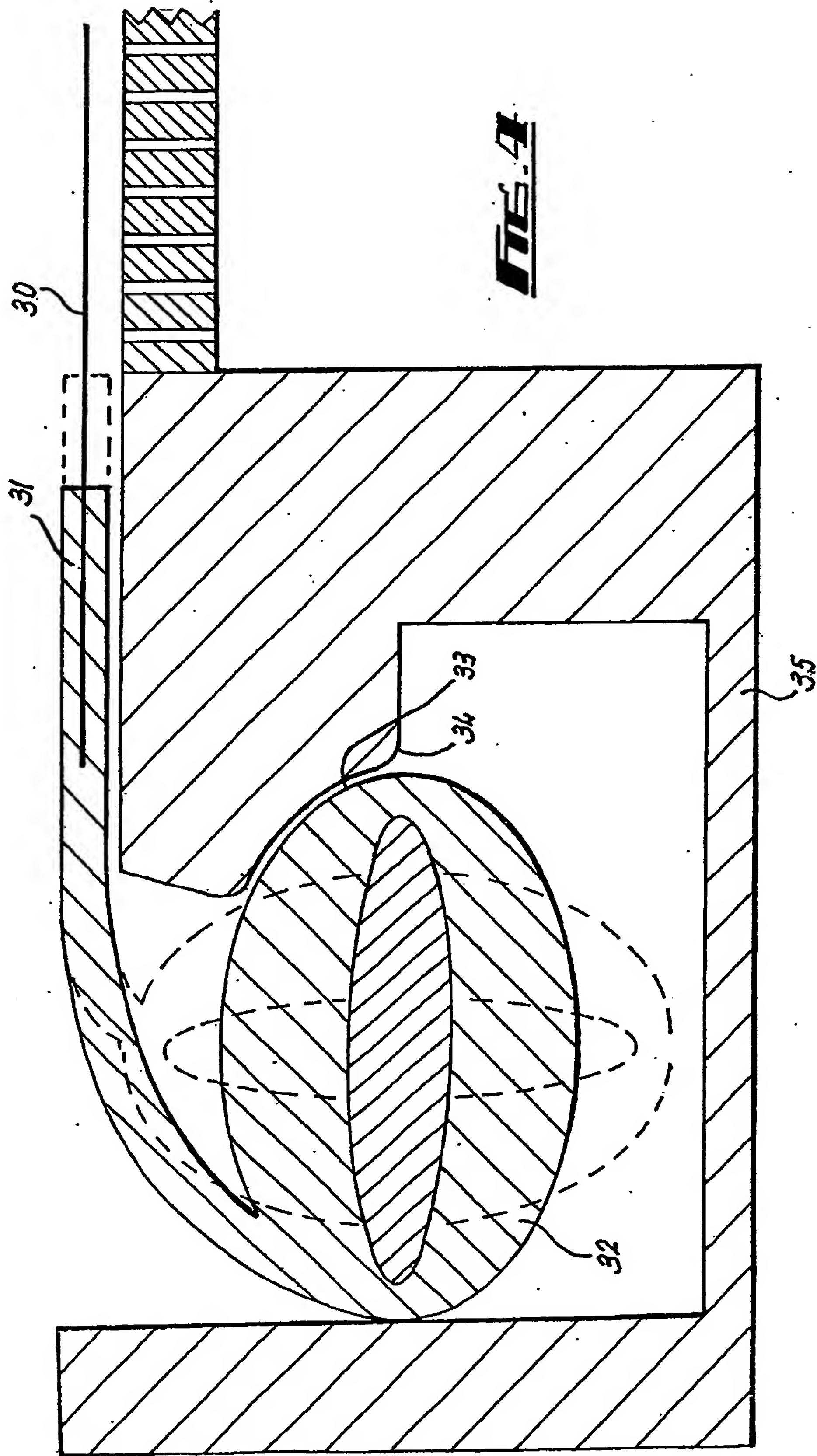
CLAIMSIMPROVED RETENTION OF FILTER ELEMENTS

- 5 1. Apparatus for retention of filter elements comprising a slotted cavity mounted in or forming part of the frame member for supporting a filter element, and an extruded bead member attached to an edge of a filter cloth wherein the bead member is profiled to provide a sealing surface which forms a seal with the edges of the slot of
10 the slotted cavity when the filter cloth is subjected to tension.
2. Apparatus according to claim 1, wherein the sealing surface is provided by a lip provided by the bead member profile, and the cavity is provided by a slotted tube.
- 15 3. Apparatus according to claim 2 wherein the bead is extruded onto a cloth strip so that the bead material forms extensions substantially covering each face of the cloth strip and the main body of the bead is formed on one edge of the strip.
- 20 4. Apparatus according to claim 2, wherein the lip is provided by a flap separated from the extension covering the face of the strip opposing the flap by a channel and extends in the same general direction as the extension from the main body of the bead.
- 25 5. Apparatus according to any preceding claim wherein the bead has a diameter sufficient to cause it to be retained by the slot of the slotted tube, being significantly larger

than the width of the slot, and is also less than the internal diameter of the slotted tube so that when placed under tension the bead can be drawn into the slot to exert sealing pressure on the flap.

- 5 6. Apparatus according to claim 2 wherein the filter element comprises a filter cloth which is attached by welding, adhesive or stitching to the side of the extension covering the cloth strip opposite to the channel and lip, so that when the cloth is subjected to tension
- 10 the cloth is gripped by one jaw of the slot of the slotted tube.
7. Apparatus according to claim 1, wherein a channel is formed in a frame member of the filter installation, and includes a bead member of generally oval cross section
- 15 whereby in a first orientation the bead member is less wide than the mouth of the channel and can be inserted therein, and in a second orientation at right angles thereto is wider than the mouth of the channel and cannot be pulled therefrom.
- 20 8. Apparatus according to claim 7 wherein the bead member includes a rigid core which is wider than the mouth of the channel.





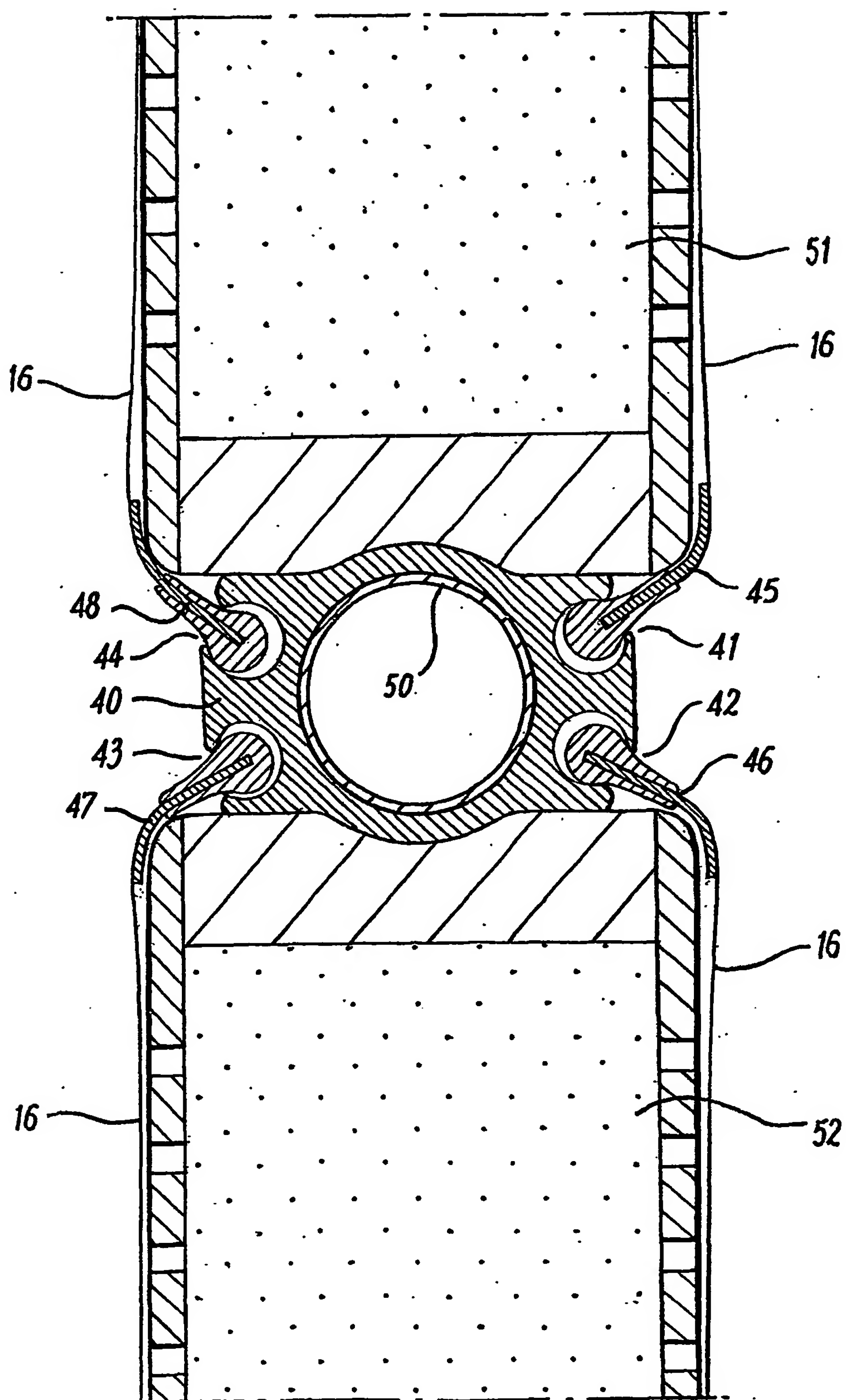


FIG. 5

International Application No

PCT/GB 03/02706

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 B01D25/176 B01D33/067

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 7 B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 636 397 A (JUNKER FILTER GMBH) 1 February 1995 (1995-02-01) column 1, line 49 - column 2, line 40 column 3, line 1 - line 28; figures 2-4	1
X	US 4 921 602 A (FROEDERBERG INGEMAR ET AL) 1 May 1990 (1990-05-01) column 2, line 21 - line 25; figures 6,7 column 4, line 47 - line 63	1
X	US 5 798 039 A (WIESEMANN FRED E) 25 August 1998 (1998-08-25) column 3, line 19 - line 29; figure 14	1
A	FR 1 306 302 A (PREP IND COMBUSTIBLES) 13 October 1962 (1962-10-13) figure 1	1,7,8
	-/-	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- *G* document member of the same patent family

Date of the actual completion of the international search

18 September 2003

Date of mailing of the international search report

25/09/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl
 Fax (+31-70) 340-3016

Authorized officer

Sembritzki, T

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 03/02706

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>WO 00 04975 A (WALTERS JOSEPH CHARLES HENRY ; SCAPA GROUP PLC (GB)) 3 February 2000 (2000-02-03) cited in the application abstract; figures 2-4</p>	1-8
A	<p>GB 1 123 134 A (POLYSIUS GMBH) 14 August 1968 (1968-08-14) figures 2-6</p>	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 03/02706

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0636397	A	01-02-1995	DE 4325235 A1	02-02-1995
			AT 143284 T	15-10-1996
			DE 59400732 D1	31-10-1996
			DK 636397 T3	17-03-1997
			EP 0636397 A1	01-02-1995
			ES 2094599 T3	16-01-1997
			US 5599446 A	04-02-1997
US 4921602	A	01-05-1990	SE 458827 B	16-05-1989
			DE 3779131 D1	17-06-1992
			EP 0336933 A1	18-10-1989
			SE 8605380 A	16-06-1988
			WO 8804570 A1	30-06-1988
US 5798039	A	25-08-1998	NONE	
FR 1306302	A	13-10-1962	NONE	
WO 0004975	A	03-02-2000	AU 746113 B2	18-04-2002
			AU 4922899 A	14-02-2000
			BR 9912191 A	10-04-2001
			CA 2338257 A1	03-02-2000
			DE 69906805 D1	15-05-2003
			EP 1144071 A2	17-10-2001
			WO 0004975 A2	03-02-2000
			US 6454940 B1	24-09-2002
			ZA 200100420 A	15-01-2002
GB 1123134	A	14-08-1968	FR 1478638 A	28-04-1967
			DE 1536870 A1	12-02-1970